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Indian Standard

GUIDANCE ON THE USE OF THE SUBSTITUTION METHOD FOR MEASUREMENTS OF RADIATION FROM MICROWAVE OVENS FOR FREQUENCIES ABOVE 1 GHz

UDC 662·9 : 641·539

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NEW DELHI 110002

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Electromagnetic Compatibility Sectional Committee, LTD 22

NATIONAL FOREWORD

This Indian Standard which is identical with CISPR Pub 19 (1983) 'Guidance on the use of the substitution method for measurements of radiation from microwave ovens for frequencies above 1 GHz', issued by the International Special Committee on Radio Interference, (CISPR) of the International Electrotechnical Commission (IEC), was adopted by the Bureau of Indian Standards on the recommendation of the Electromagnetic Compatibility Sectional Committee (LTD 22) and approval of the Electronics and Telecommunication Division Council.

The text of the CISPR standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCES

The technical committee responsible for the preparation of this standard has reviewed the provisions of the CISPR Pub 11 (1975) 'Limits and methods of measurement of radio interference characteristics industrial, scientific and medical (ISM) radio frequency equipment (excluding surgical diathermy apparatus)', and has decided that this is acceptable for use in conjunction with this standard.

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

Indian Standard

GUIDANCE ON THE USE OF THE SUBSTITUTION METHOD FOR MEASUREMENTS OF RADIATION FROM MICROWAVE OVENS FOR FREQUENCIES ABOVE 1 GHz

1. General

1.1 Many household and commercial microwave ovens are small, their largest dimension being less than 1 m. The measurement procedure for such equipment is detailed in Clause 2, and the procedure for other equipment in Clause 3. In either case, test loading of the oven is to be carried out according to Sub-clause 5.3.4 of C.I.S.P.R. Publication 11: Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment (Excluding Surgical Diathermy Apparatus).

1.2 The measurement procedures contained in Clauses 2 and 3 are to be repeated for both horizontal and vertical polarization at each test frequency. It should be noted that the turning point distance defined in Clause 3 is normally a function of frequency, and therefore it should be determined at each test frequency.

1.3 If the frequency range of the receiving horn aerial includes the fundamental frequency used in the microwave oven, precautions must be taken to ensure that the fundamental frequency does not affect the readings.

1.4 The measurements detailed in Clause 2, and where possible those detailed in Clause 3, should be carried out on a test site which is flat, free of overhead wires and nearby reflecting structures as well as sufficiently large to permit aerial placement at the specified distance while providing adequate separation between the aerial, the microwave oven under test and reflecting structures. A suitable test site is depicted in Figure 3, page 9.

2. Measurement procedures for small microwave ovens

2.1 For microwave ovens whose largest physical dimension is less than 1 m, the following measurement procedure is to be employed. The microwave oven under test is placed on a non-metallic turntable, the height of the bottom of the microwave oven being 1 m above the ground. The receiving horn aerial is mounted at a height equal to 1 m plus half of the height of the microwave oven under test (see Figure 1, page 8). In order that the near-field effects associated with the radiation from the microwave oven do not affect the measurement, the receiving horn aerial must be located at a distance of $R = 3$ m from the nearest surface of the microwave oven under test (provided that the maximum aperture dimension D of the receiving horn aerial is such that $D < \sqrt{3\lambda/2}$, where λ is the wavelength of the test frequency and where D and λ are both expressed in metres. If this condition is not satisfied, the receiving horn aerial must be placed at a distance of $R = 2\ D^2/\lambda$ from the nearest surface of the microwave oven under test. The position of the receiving horn aerial should be varied slightly to ensure that it is not located at a maximum or minimum caused by special combinations of radiating patterns and reflections. The microwave oven under test is then rotated through 360° in the horizontal plane and the highest reading Y is recorded as the level of radiated interference at that test frequency.

2.2 With the microwave oven under test removed from the test area, a transmitting horn aerial is placed with its centre of radiation at that point in space formerly occupied by the surface of the microwave oven under test nearest to the receiving horn aerial. In order to obtain its specified gain, the transmitting horn aerial must be such that $2\ D^2/\lambda < R$, where D is its major aperture dimension. The transmitting horn aerial must be directed so that the receiving horn aerial is in the direction of maximum gain and of the same polarization as the transmitting horn aerial (see Figure 1, page 8). The position of the transmitting horn aerial is then varied slightly to ensure that the receiving horn aerial is not located at a maximum or minimum caused by special combinations of radiating patterns and reflections. The signal generator supplying power to the transmitting horn aerial is adjusted to give the same indication on the measuring set Y as recorded with the microwave oven under test. This power at the input terminal of the transmitting horn aerial P_tdB(pW) plus the gain of the transmitting horn aerial (GdB) minus the gain of a half-wave dipole (which can be taken as 2 dB) is compared with the limit, i.e. $Y + G - 2.0 \leqslant L$ dB(pW).

3. Measurement methods for large microwave ovens

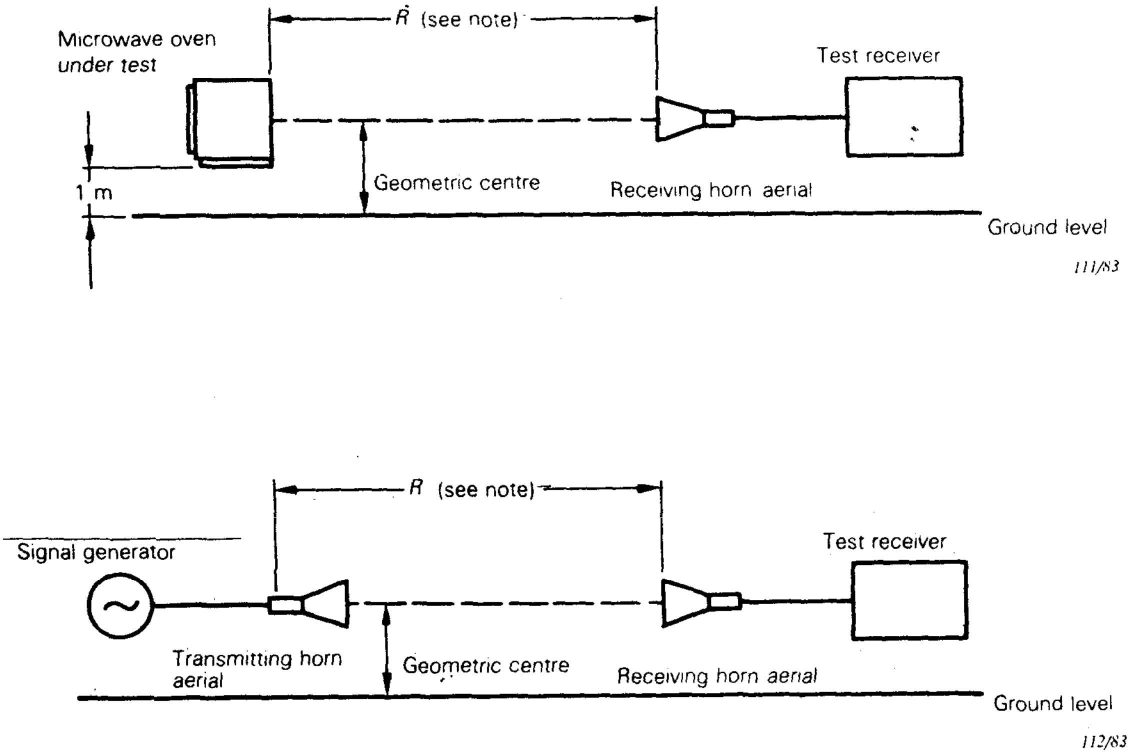
3.1 For microwave ovens with their largest physical dimension exceeding 1 m, the following procedure is to be employed to ensure a good estimate of the levels of radiated interference. Under free space conditions, the power received by an aerial falls off with distance at a rate of 20 dB per decade. If the receiving aerial is too close to the source, then near-field effects caused by the physical dimensions of the source produce deviations from the fallrate of 20 dB per decade. In order to avoid errors, it is necessary to make measurements with the receiving aerial far enough away from the source to ensure that the near-field effects are insignificant.

3.2 First, the direction of maximum radiation from the equipment under test must be determined by using a low gain (about 6 dB) horn aerial. The search for the direction of maximum radiation is then carried out as far from the source as possible without incurring signal-to-noise problems.

3.3 The variation of measured radiated power in the direction of maximum radiation with distance from the equipment under test is plotted as in Figure 2, page 8. The turning point distance is determined by drawing straight lines 5 dB apart (the lines being horizontal at the shorter distances and having a gradient of 20 dB per decade at greater distances) and positioned so as to include a maximum number of recorded values. The receiving horn aerial should not be placed closer to the equipment under test than the turning point distance obtained, and a receiving horn aerial should be selected such that $2\ D^2/\lambda$ is less than the turning point distance.

3.4 For those equipments under test which can be put on a turntable, the same measurement procedures as specified in Sub-clauses 2.1 and 2.2 are to be used for evaluating the levels of radiated interference, using a value of R equal to the turning point distance.

3.5 If the equipment under test is an installation, or cannot be placed on a turntable, then the turning point distance is found as described in Sub-clauses 3.2 and 3.3. The measuring equipment used must be calibrated so that the radiated interference field strength can be determined without the substitution of the microwave oven by a transmitting horn aerial as specified in Sub-clause 2.2.



Note. — To determine the distance *R*, the point of measurement at the aerial shall be either at its feeding point or at its aperture, as specified by the aerial manufacturer.

FIG. 1. — Method of measurement — Substitution method.

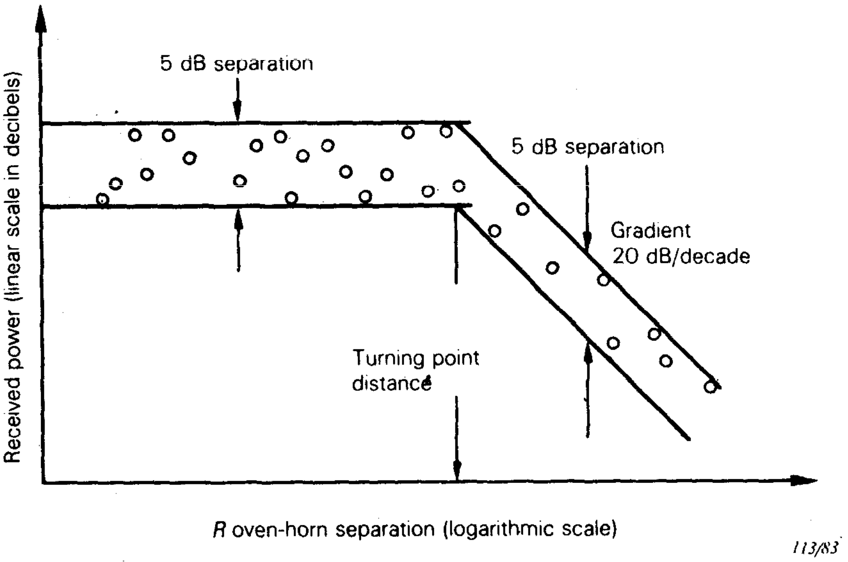
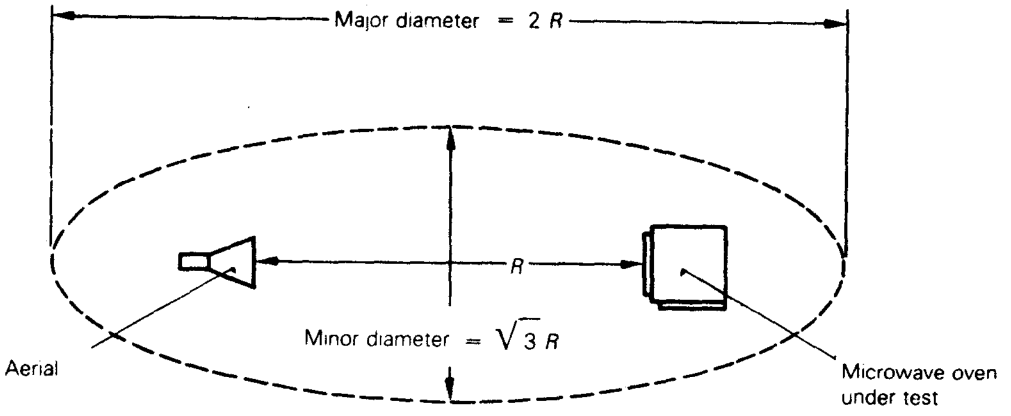


FIG. 2.— Determination of turning point distance for test objects with physical dimensions larger than 1 m.



Boundary of test site defined by an ellipse. The volume above the test site is to be free of reflecting objects.

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FIG. 3.— Test site.

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